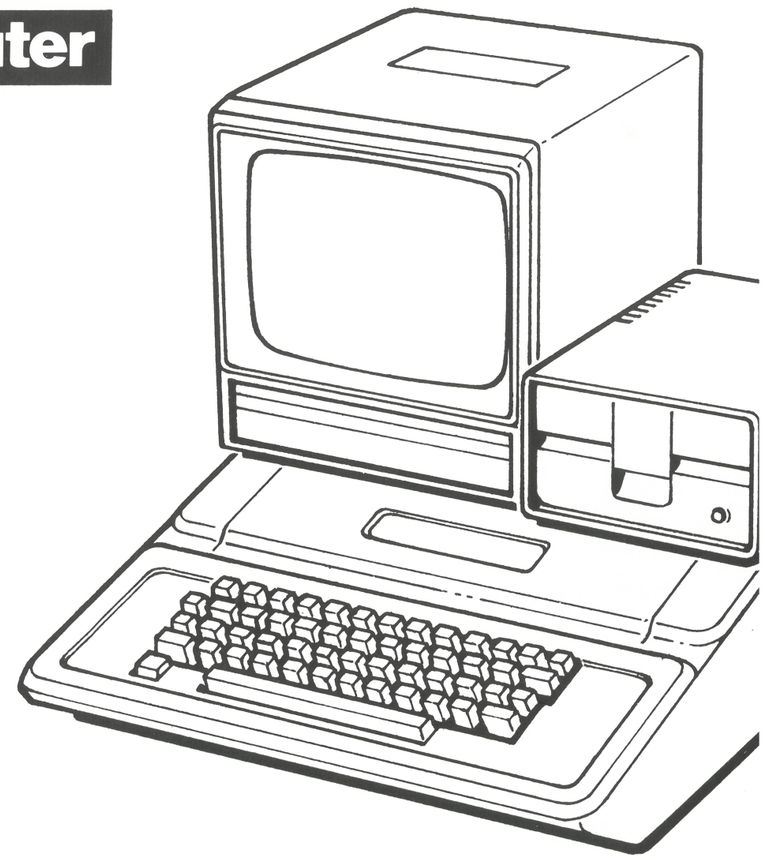
E.M.E

microcomputer program



SHADOWS AND LIGHT

STUDY GUIDE

by

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OVERVIEW

The E.M.E SHADOWS AND LIGHT program provides elementary students with an introduction to the basics of light by emphasizing how shadows are formed. The program consists of two parts:

1. Explanation -- illustrates how a light source and objects create shadows and reflect light. Also explains the terms opaque, transparent and translucent. A convenient forward/backward feature allows review at any point.

2. Quiz -- consists of 20 randomly-selected questions where students identify the shadows of different blocks placed in various positions and at different distances from a light source. Quiz score is provided at the end.

After students study the Explanation section of the program, they will be ready to experiment with shadows and light on their own and solve the problems in the Quiz portion of the program.

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OBJECTIVES

The following concepts are developed in the program:

1. The requirements to create a shadow are: a light source, an object to block the light and a surface on which the shadow can fall.

2. The sun, other stars, electric lights, flashlights and fire are sources of light.

3. Most objects reflect light. The moon, mirrors and other objects reflect light that strikes them. They are not light sources.

4. Shadows can be created by light from direct sources and by reflected light.

5. Shadows can be cast by objects that are translucent and opaque. Generally, the opaque object will cast the darker shadow.

6. A single object may cast shadows of more than one shape.

7. By moving the object, or the light or the screen, one can change the size and shape of the shadow.

After using the program the students will be able to:

1. Determine which objects reflect light and which are light sources.

2. Classify materials as opaque, transparent or translucent.

3. Predict the different shadows an object can cast.

4. Discover an object that can cast only one shape of shadow.

5. Predict how moving an object toward the light or toward the screen will change the size and shape of the object's shadow.

USING THE PROGRAM

The SHADOWS AND LIGHT program is easy to use and is under your control at all times. The program loads automatically and is ready to use immediately. We suggest that students start with the Explanation section. This provides the background needed to understand shadows and light and to answer the questions in Part 2. The program is designed for Grades 2 and up.

You may wish to assign one student who has taken the quiz as your representative at the computer to record for you the scores of other students who take the quiz. The SHADOWS AND LIGHT Quiz may also be used as an evaluation instrument by teachers who have completed a unit on this topic.

BACKGROUND

Anything that can produce light is called a light source. Examples are the sun, other stars, electric light and burning substances.

The majority of objects we see do not produce light but rather reflect light produced by a light source. For example, the moon reflects the sun's light. Mirrors and shiny objects are good reflectors. When light strikes an object it may pass through the object, be reflected or be absorbed. At times there is a combination of all three.

Anything you can see is capable of casting a shadow. Objects that are opaque cast the darkest shadows. Transparent substances allow some light through and thus cast lighter shadows than opaque objects. Transparent objects, which allow almost all of the light through, cast the lightest shadows. A clear plastic sandwich bag will cast a shadow as

will a clear glass tumbler. Water placed in the tumbler will cast a deeper shadow. If you use a straw to blow air into the water, you will find that bubbles in the water will cast shadows.

One object can cast different shadows depending on its position in relation to the light. A book, for example, will cast these shadows with light striking its:

front cover

spine

top

Shadows from a sphere are unique in one way. For a given arrangement of light source, sphere and screen, the sphere's shadow stays the same however the sphere is rotated. Curved objects can cast straight shadows and straight objects can cast curved shadows if you bend the screen on which they fall.

When an object between the light source and the screen is moved toward the light its shadow becomes larger. But as its shadow becomes larger, it also becomes fuzzier. Conversely, as an object moves toward the screen, its shadow becomes smaller and sharper.

ADDITIONAL ACTIVITIES

To perform experiments similar to those presented in the Quiz part of the program obtain a strong light source (large flashlight or filmstrip projector), various objects (balls, blocks, ruler, pencils, empty spools and tubes), and a screen (large sheet of white paper or white cloth). Set up the screen in front of the students (a sheet hung in a doorway works well). Place a light source behind the screen and hold objects between the screen and light source. The objects will cast shadows on the screen. Students cannot see the object but they can see its shadow. Ask them to guess what the object is by its shadow. (The shadow cast by a belt is challenging because it can be rolled up to cast a circular shadow, held on its side for a rectangle shape and unrolled to produce a long rectangle.)

During a sunny day, have students mark the top of a shadow cast by a vertical stake

or flagpole hour-by-hour through the school day. Ask students to explain the pattern found.

TEXTBOOK CORRELATION GUIDE

Addison Wesley Science	Book 3, Chapter 6
Coronado Science & Technology	Book 3, Unit 3, Chapter 9
Harcourt Brace Science	Book 2, Unit 5 Book 4, Unit 3, Chapters 1,2
Heath Science	Book 2, Unit 3, Chapter 4
Holt Elementary Science	Book 4, Unit 2, Chapter 2 Book 6, Unit 3, Chapter 7
Laidlaw Exploring Science	Book 1, Unit 4
Merrill Accent on Science	Book 2, Chapter 6 Book 4, Unit 2, Chapter 1
Scott Foresman Science	Book 3, Chapter 3
Silver Burdett Science	Book 2, Unit 8 Book 3, Unit 3, Chapters 1,2 Book 6, Unit 2, Chapter 7

GLOSSARY

cast: To form or create (a shadow).

light source: An object or device which can produce light.

opaque: Not allowing light to pass through.

reflect: To throw back (especially light) on being struck.

translucent: Allowing some light to pass, but not allowing objects beyond to be seen clearly.

transparent: Transmitting enough light so objects on the other side can be seen clearly.

RESOURCES

Gardner, Robert and Webster, David: SHADOW SCIENCE, Doubleday, Garden City, New York 1976.

Goor, Ron and Goor, Nancy: SHADOWS: HERE, THERE AND EVERYWHERE, Thomas Y. Crowell, New York, 1981.

Schneider, Herman: SCIENCE FUN WITH A FLASHLIGHT, McGraw-Hill, New York, 1975.

This program uses a high-speed operating system called Diversi - DOS (tm) under license. For information contact DSR, Inc., 34880 Bunker Hill, Farmington MI 48018.

Name_____

Student Worksheet

SHADOWS AND LIGHT

1. What three things are required to cast a shadow?

   A. B. and C.

2. Circle the light sources in the following list:

moon	sun	match	diamond
candle	window	mirror	telephone pole
gold	star	flashlight	electric light

3. Circle the correct answer.

   A. Which objects cast the darkest shadow?

      opaque translucent transparent?

   B. Which objects cast the lightest shadow?

      opaque translucent transparent

4. How can you make the shadow of an object larger?

5. Write the letter(s) of the objects under the shadows they can cast.

   A. baseball
   B. book
   C. can
   D. doughnut
   E. cube
   F. pyramid
   G. cone

6. During an eclipse of the moon the light source is_____, the object casting the shadow is_____and the screen is_____.

STUDENT WORKSHEET ANSWERS

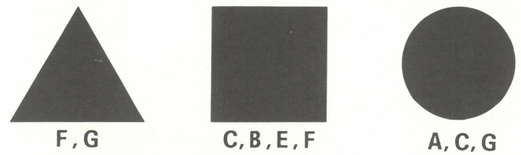
1. light source, object and screen

2. light sources: candle, sun, star, flashlight, match and electric light

3A. opaque 3B. transparent

4. Move the object closer to the light source.

5.



6. During an eclipse of the moon the light source is the sun, the object casting the shadow is the earth and the screen is the moon.